Real-Time Polymerase Chain Reaction (PCR) Capability in Space

Completed Technology Project (2012 - 2013)

Project Introduction

The goal of this project is enabling the real-time polymerase chain reaction (real-time PCR) technology in space. In space, the real-time PCR technology can be used for multiple applications, including detection of infectious pathogens and environmental contaminations, monitoring of drug-resistant microbial and dangerous mutations, and identification of new phenotypes of microbial and new species. The system will also allow scientists to study in orbit the effects of spaceflight factors in living organisms at the molecular level. A real-time PCR offers supreme rapidity, sensitivity and reproducibility over other technologies. However, a technological blockade for in-orbit analysis is the lack of devices for sample preparation in the microgravity environment. The first step of this project is to develop a self-enclosed and automated device for isolation and preparation of biological samples to be analyzed with advanced molecular diagnostic techniques, such as real-time polymerase chain reaction (PCR), in space.

Our DNA/RNA isolation and preparation device is a fluidic system with components including syringes and pistons, membranes of different capacities, reagents, valves, and a small pump. In Year 1 of the project, we constructed several self-enclosed prototypes for sample preparation, and demonstrated that the quality of the DNA/RNA samples isolated using our device is similar following the standard laboratory procedures. Year 2 of the project is devoted to the development of an automated system that can process multiple samples simultaneously. The project will be completed in Year 3 with the development of the software that controls the movement of the syringe plungers in a programmed manner for processing different biological samples.

Anticipated Benefits

For NASA, our device can be used on ISS for biomedical research such as investigations of changes of genome in space.

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

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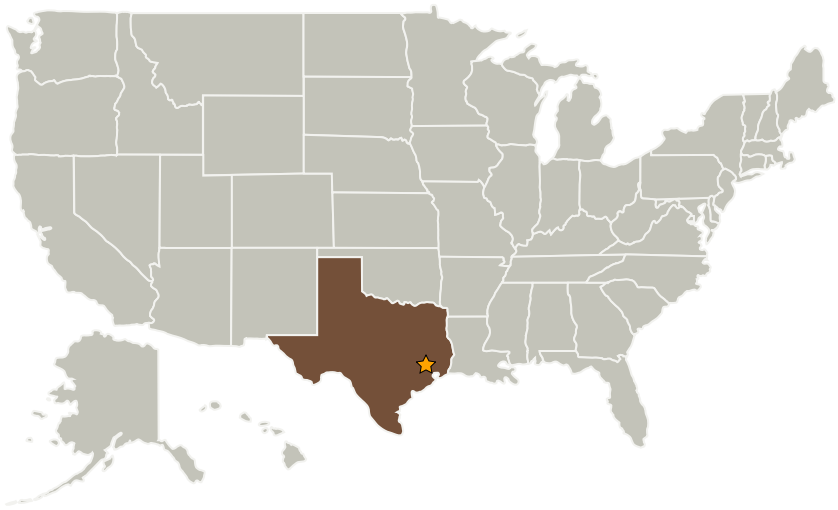
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations
Texas

Project Management

Program Director:
Michael R Lapointe

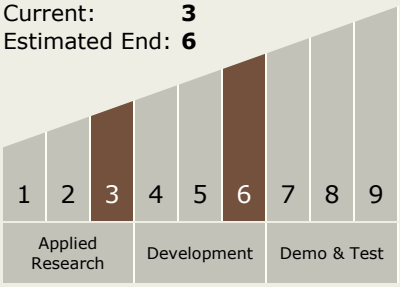
Program Manager:
Carlos H Westhelle

Project Manager:
Honglu Wu

Principal Investigator:
Honglu Wu

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **6**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.3 Sample Handling